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AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING  
ENGINEERS (ASHRAE)

ASHRAE 62.1 (2004) Ventilation for Acceptable Indoor  
Air Quality; includes Addenda in Appendix H

ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 402-C-01-001 (2001) IAQ Building Education and  
Assessment Tool (I-BEAM)

EPA 402-F-91-102 (1991) Building Air Quality: A Guide for  
Building Owners and Facility Managers

NATIONAL AIR DUCT CLEANERS ASSOCIATION (NADCA)

NADCA ACR (2006) Standard for Assessment, Cleaning,  
and Restoration of HVAC Systems

NADCA HVAC Inspection Manual (2005) Procedures for Assessing the  
Cleanliness of Commercial HVAC Systems

NORTH AMERICAN INSULATION MANUFACTURERS ASSOCIATION (NAIMA)

NAIMA AH112 (1993) Cleaning Fibrous Glass or Lined  
Sheet Metal Ducts

NAIMA AH122 (2006) Cleaning Fibrous Insulated Duct  
Systems - Recommended Practices

NAIMA AH127 (1999) Impact of Duct Cleaning on Internal  
Duct Insulation

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION  
(SMACNA)

SMACNA (2005) HVAC Duct Construction Standards -  
Metal and Flexible, 3rd ed

UNDERWRITERS LABORATORIES (UL)

UL 181 (2005) Factory-Made Air Ducts and Air  
Connectors

UL 181A (2006) Closure Systems for Use with Rigid  
Air Ducts and Air Connectors

UL 181B (2005) Closure Systems for Use With  
Flexible Air Ducts and Air Connectors

1.2 QUALIFICATION OF THE HVAC SYSTEM CLEANING CONTRACTOR

1.2.1 Membership

The HVAC system cleaning contractor must be a certified member of the  
National Air Duct Cleaners Association (NADCA ACR), or must maintain  
membership in a nationally recognized non-profit industry organization  
dedicated to the cleaning of HVAC systems.

### 1.2.2 Certification

The HVAC system cleaning contractor must have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by [NADCA ACR](#) on a full time basis, or must have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems in full compliance with [ASHRAE 62.1](#).

### 1.2.3 Supervisor Qualifications

A person certified as an ASCS by [NADCA ACR](#), or maintaining an equivalent certification by a nationally recognized program and organization, must be responsible for the total work herein specified. Inspection work must conform to [NADCA HVAC Inspection Manual](#).

### 1.2.4 Experience

Submit records of experience in the field of HVAC system cleaning. Bids will only be considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.

### 1.2.5 Equipment, Materials and Labor

Possess and furnish all necessary equipment, materials and labor to adequately perform the specified services and comply with the applicable provisions of [ASHRAE 62.1](#).

- a. Assure that all employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work by the U.S. Occupational Safety and Health Administration, and as described by this specification. For work performed in countries outside of the U.S.A., comply with applicable national safety codes and standards.
- b. Maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification
- c. Submit all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.

### 1.2.6 Licensing

The HVAC system cleaning contractor must provide proof of maintaining the proper license(s), if any, as required to do work in this state. Comply with all Federal, state and local rules, regulations, and licensing requirements.

## 1.3 STANDARDS

### 1.3.1 NADCA Standards

Perform the services specified here in accordance with the current published standards of the National Air Duct Cleaners Association ([NADCA ACR](#) and [NADCA HVAC Inspection Manual](#)).

- a. All terms in this specification have their meaning defined as stated in the NADCA Standards.
- b. NADCA Standards must be followed with no modifications or deviations being allowed.

#### 1.4 DOCUMENTS

##### 1.4.1 Mechanical Drawings

Obtain one copy of the following documents:

- a. Project drawings and specifications
- b. Approved construction revisions pertaining to the HVAC system
- c. Any existing indoor air quality (IAQ) assessments or environmental reports prepared for the facility.

#### PART 2 PRODUCTS

Not Used

#### PART 3 EXECUTION

Not Used

##### 3.1 SCOPE OF WORK

###### 3.1.1 Scope

This section defines the **minimum** requirements necessary to render HVAC components clean, and to verify the cleanliness through inspection and/or testing in accordance with items specified herein and applicable NADCA Standards.

Remove visible surface contaminants and deposits from within the HVAC system in strict accordance with these specifications.

The HVAC system includes any interior surface of the facility's air distribution system for conditioned spaces and/or occupied zones. This includes the entire heating, air-conditioning and ventilation system from the points where the air enters the system to the points where the air is discharged from the system. The return air grilles, return air ducts (except ceiling plenums and mechanical room) to the air handling unit (AHU), the interior surfaces of the AHU, mixing box, coil compartment, condensate drain pans, humidifiers and dehumidifiers, supply air ducts, fans, fan housing, fan blades, air wash systems, spray eliminators, turning vanes, filters, filter housings, reheat coils, and supply diffusers are all considered part of the HVAC system. The HVAC system may also include other components such as dedicated exhaust and ventilation components and make-up air systems.

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**Note: Users of this specification must modify the above paragraph to succinctly and specifically define those systems and components requiring cleaning.**

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### 3.2 HVAC SYSTEM INSPECTIONS AND SITE PREPARATIONS

#### 3.2.1 HVAC System Evaluation

Prior to the commencement of any cleaning work, perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete this project.

**Document damaged system components found during the inspection and submit to the contract administrator.**

#### 3.2.2 Site Evaluation and Preparations

Conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.

### 3.3 GENERAL HVAC SYSTEM CLEANING REQUIREMENTS

#### 3.3.1 Containment

Collect debris removed during cleaning and take precautions to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.

#### 3.3.2 Particulate Collection

Where the Particulate Collection Equipment is exhausting inside the building, use HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater). When the Particulate Collection Equipment is exhausting outside the building, undertake Mechanical Cleaning operations only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, take precautions to locate the equipment down wind and away from all air intakes and other points of entry into the building.

#### 3.3.3 Controlling Odors

Take all reasonable measures to control offensive odors and/or mist vapors during the cleaning process.

#### 3.3.4 Component Cleaning

Employ cleaning methods such that all HVAC system components are visibly Clean as defined in applicable standards. Upon completion, return all components to those settings recorded just prior to cleaning operations.

#### 3.3.5 Air-Volume Control Devices

Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.

#### 3.3.6 Service Openings

Utilize service openings, as required for proper cleaning, at various

points of the HVAC system for physical and mechanical entry, and inspection.

Utilize the existing service openings already installed in the HVAC system where possible.

Create other openings where needed and they must be created so they can be sealed in accordance with industry codes and standards.

Closures must not significantly hinder, restrict, or alter the air-flow within the system.

Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.

Openings must not compromise the structural integrity of the system.

Construction techniques used in the creation of openings must conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA and NADCA Standards.

Cutting service openings into flexible duct is not permitted. Disconnect flexible duct at the ends as needed for proper cleaning and inspection.

Reseal rigid fiber glass ductboard duct systems in accordance with NAIMA recommended practices; [NAIMA AH112](#), [NAIMA AH122](#), and [NAIMA AH127](#). Only closure techniques which comply with [UL 181](#); [UL 181A](#), or [UL 181B](#) are suitable for fiber glass duct system closures.

All service openings capable of being re-opened for future inspection or remediation must be clearly marked and must have their location reported in project report documents.

#### 3.3.7 Ceiling Sections (Tile)

Remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.

#### 3.3.8 Air Distribution Devices (Registers, Grilles and Diffusers)

Clean all air distribution devices.

#### 3.3.9 Air Handling Units, Terminal Units, Blowers and Exhaust Fans

Insure that supply, return, and exhaust fans and blowers are thoroughly cleaned. Areas to be cleaned include blowers, fan housings, plenums (except ceiling supply and return plenums), scrolls, blades, or vanes, shafts, baffles, dampers and drive assemblies. Remove all visible surface contamination deposits in accordance with NADCA Standards.

- a. Clean all air hadling unit (AHU) internal surfaces, components and condensate collectors and drains.
- b. Assure that a suitable operative drainage system is in place prior to beginning wash down procedures.
- c. Clean all coils and related components, including evaporator fins.



### 3.3.10 Duct Systems

- a. Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas.
- b. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Testings NADCA Standards).

## 3.4 HEALTH AND SAFETY

### 3.4.1 Safety Standards

Comply with all applicable federal, state, and local requirements for protecting the safety of the contractors' employees, building occupants, and the environment. In particular, follow all applicable standards of the Occupational Safety and Health Administration (OSHA) when working in accordance with this specification.

### 3.4.2 Occupant Safety

Employ no processes or materials in such a manner that they will introduce additional hazards into occupied spaces.

### 3.4.3 Disposal of Debris

Dispose of all debris removed from the HVAC System in accordance with applicable federal, state and local requirements.

## 3.5 MECHANICAL CLEANING METHODOLOGY

### 3.5.1 Source Removal Cleaning Methods

Clean the HVAC system using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. Select Source Removal methods which will render the HVAC system Visibly Clean and capable of passing cleaning verification methods NADCA Standards and other specified standards and tests, in accordance with all general requirements. Use no cleaning method, or combination of methods, which could potentially damage components of the HVAC system or negatively alter the integrity of the system.

Incorporate the use of vacuum collection devices that are operated continuously during cleaning for all methods used. Connect a vacuum device to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment is assured.

Equip all vacuum devices exhausting air inside the building, including hand-held vacuums and wet-vacuums, with HEPA filters (minimum efficiency).

Equip all vacuum devices exhausting air outside the facility with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices must exhaust in a manner that

will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.

All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.

#### 3.5.2 Methods of Cleaning Fibrous Glass Insulated Components

Thoroughly clean glass thermal or acoustical insulation elements present in any equipment or ductwork with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.

Cleaning methods used must not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (NADCA Standards).

#### 3.5.3 Damaged Fibrous Glass Material

If there is any evidence of damage, deterioration, delamination, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, identify them for replacement.

When requested or specified, be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.

#### 3.5.4 Replacement Material

In the event fiber glass materials must be replaced, all materials must conform to applicable industry codes and standards, including those of UL and **SMACNA**.

Replacement of damaged insulation is **not** covered by this specification.

#### 3.5.5 Cleaning of Coils

Use any cleaning method which will render the Coil Visibly Clean and capable of passing Coil Cleaning Verification applicable NADCA Standards. Coil drain pans are subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan must be operational. Cleaning methods must not cause any appreciable damage to, displacement of, inhibit heat transfer, or erosion of the coil surface or fins, and must conform to coil manufacturer recommendations when available. Thoroughly rinse coils with clean water to remove any latent residues.

#### 3.5.6 antimicrobial Agents and Coatings

Only apply antimicrobial agents if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.

Perform application of any antimicrobial agents used to control the growth of fungal or bacteriological contaminants after the removal of surface

deposits and debris.

Use only antimicrobial agents registered by the U.S. Environmental Protection Agency (EPA 402-F-91-102 ) (EPA 402-C-01-001) specifically for use within HVAC system.

Apply antimicrobial agents in strict accordance with manufacturer's instructions.

Antimicrobial coating products for both porous and non-porous surfaces must be EPA registered, water soluble solutions with supporting efficacy data and MSDS records.

Apply antimicrobial coatings according to manufacturer's instructions. Spray coatings directly onto interior ductwork surfaces, rather than "fog" downstream onto surfaces. A continuous film must be achieved on the surface to be treated by the coating application. Application of any antimicrobial coatings must be in strict accordance with manufacturer's minimum millage surface application rate standards for effectiveness.

### 3.6 CLEANLINESS VERIFICATION

#### 3.6.1 General

Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including antimicrobial agents and coatings.

#### 3.6.2 Visual Inspection

Visually inspect the HVAC system to ensure that no visible contaminants are present.

If no contaminants are evident through visual inspection, consider the HVAC system clean; however, further verification of the system cleanliness through gravimetric or wipe testing analysis testing may be requested as specified herein.

If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible must be re-cleaned and subjected to re-inspection for cleanliness.

#### 3.6.3 Gravimetric Analysis

At the expense of the **contractor**, sections of the HVAC system may be tested for cleanliness using the NADCA Vacuum Test (gravimetric analysis) as specified in applicable NADCA Standards. Levels of debris collected must be equal to or less than acceptable levels defined in applicable NADCA Standards.

If gravimetric analysis determines that levels of debris are equal to or lower than those levels specified, the system must be considered clean and must have passed cleanliness verification.

If gravimetric analysis determines that levels of debris exceed those specified in applicable NADCA standards, the system must not be considered clean and those sections of the system which failed cleanliness verification must be re-cleaned at the expense of the HVAC system cleaning

contractor.

Gravimetric analysis must be performed by a qualified third party experienced in testing of this nature.

Cleanliness verification must be performed immediately after mechanical cleaning and before the HVAC system is restored to normal operation.

#### 3.6.4 Verification of Coil Cleaning

Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see [NADCA HVAC Inspection Manual](#) Standards).

#### 3.7 PRE-EXISTING SYSTEM DAMAGE

Contractor is not responsible for problems resulting from prior inappropriate or careless cleaning techniques of others.

#### 3.8 POST-PROJECT REPORT

At the conclusion of the project, provide a report indicating the following:

- a. Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
- b. Areas of the system found to be damaged and/or in need of repair.

-- End of Section --